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The impact of risk perception and preference on farmland transfer-out: Evidence from a survey of farm households in China☆,☆☆

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ABSTRACT

This study examines the impact of farmers' risk perceptions on their decision to transfer-out farmland, as well as the variations in this influence based on different risk preferences. The research utilizes survey data from 1389 farmers in rural China. By expanding the decision-making model for farmer households within the context of risk perception, this paper analyzes the equilibrium point of farmers' decision-making using mathematical models. Employing the Probit and Tobit models with instrumental variable methods, we discovered that farmers' perceptions of land revenue risk, land use risk, and non-farm employment risk significantly hindered the decision and rate of farmland transfer-out. Notably, the inhibitory effect decreased progressively. Moreover, risk preference was found to moderates the negative impacts. However, it is worth noting that risk perception remains a crucial factor impeding farmland transfer, primarily due to the prevalence of neutral or risk-averse risk preferences among most farmers. This study presents a novel perspective and explanatory framework for development of the farmland circulation market, aiming to overcome existing challenges from a risk-oriented standpoint. Consequently, it is essential for the government to carefully address all risks associated with farmland transfer, enhance the income guarantee system for farmers post-transfer, and offer non-farm employment training and job opportunities to facilitate the healthy and rapid development of the agricultural land transfer market.

1. Introduction

Given the large population and fragmented land in rural China, the rational allocation of farmland resources holds immense significance for the livelihoods of farmers, national food security, labor employment, and the overall development of the national economy [1,2]. In order to facilitate the transfers of cultivated land to farm households with advanced agriculture capacities, the Chinese government has been actively fostering land transfers since 2004. This initiative has garnered widespread agreement among scholars and practitioners, promoting the circulation of farmland [3–5]. Over time, as property rights and labor mobility have

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progressively strengthened, the participation rate in farmland transfer has steadily increased in China.

However, due to unclear land contracting relationships and unregulated transfer-out, the number of land transfer-out dispute cases nationwide reached 188,000 in 2013. Approximately 70% of the households participating in land transfer experienced damages to their rights and interests, with 50% of them being severely affected. As of the end of 2018, there were a total of 347,346 disputes related to farmland, with 27.8% of them involving farmland transfer-out. The majority of transfer-out disputes, approximately 75.43%, occurred between farmers themselves, while 14.33% involved farmers and new agricultural management entities [6]. These issues not only give rise to social conflicts but also jeopardize rural social stability, hindering the benign development of the farmland circulation market [7]. According to the statistical data from China's Ministry of Agriculture and Rural Affairs, the national farmland turnover area has reached 532, 189, 200 acres in the household contract area by the end of 2020. However, the growth rate of farmland circulation has declined significantly from 55.19% in 2008 to 4.3% in 2020 [8,9]. Consequently, the development of farmland transfer has reached a bottleneck.

Numerous studies have investigated the factors hindering the circulation of farmland. These studies have identified various external factors at the macro level, including the property rights system, transaction costs, and village environment [10–15]. Additionally, the internal factors at the micro level, such as farm household characteristics, resource endowment, and labor mobility, have also been considered [16,17]. However, these studies have fallen short in explaining the current dilemma, and the resulting policies have not met expectations. It is crucial to recognize that rational farmers' behavior is influenced by risk. The potential risks associated with farmland circulation, such as property loss, unemployment risk, and ecological damage, can significantly impact farmers' ability to effectively allocate land resources and derive reasonable returns. Moreover, the complex nature of supervision, contract negotiation, and signing during farmland transfer, which essentially involves the transfer of farmland management rights, can lead to disputes [18–21]. Such disputes arise due to the inherent risks associated with management rights transactions, including irregular forced transfer-outs, contract breaches, and abandonment of farming. In addition to these risks, factors such as land revenue risk, property rights adjustment risk, unemployment risk, and land use risk can also contribute to farmers' challenges in allocating land resources and property returns in a rational manner [18,22]. Recognizing these realities, analyzing the stagnation of the farmland circulation market through the lens of risk perception can enhance the efficiency of farmland circulation.

The existing literature on the impact of risk perception on farmers' decision-making behavior have assessed farmers' risk perception and risk attitude in agricultural production [23–25]. These studies primarily concentrate on agricultural production and operation decisions, particularly regarding fertilizer investment [26–28] and the adoption of new technologies [29–31]. While some studies have explored the risks associated with farmland circulation, they have only focused on qualitative discussion regarding risk identification, causes, and preventive measures. For instance, Sun et al. conducted experimental games to measure farmers' overall risk avoidance coefficient and discovered that although it did not significantly affect transfer behavior, it had a notable inhibitory effect on the transfer out behavior of farmland [32]. The process of farmland transfer encompasses various "hidden risks", that influence farmers' overall risk awareness and significantly deter their willingness to engage in farmland transfer [33]. Additionally, Yang introduced the concept of farmers' risk attitude to examine their behavior and found that farmers with distinct risk preferences exhibited heterogeneous behavioral responses [34].

The aforementioned studies highlight the risk associated with farmland transfer-out and their influence on decision-making behavior of farmland transfer-out. However, there is still scope for further exploration. Firstly, the insufficient consideration of multi-dimensional risk perception hampers the decision-making process regarding farmland circulation from the perspective of farmland suppliers. This paper aims to address this issue by focusing on the collective advantages of farmers as members of a group. It emphasizes the importance of understanding the multi-dimensional risk expectations of the farmland transfer party. Secondly, existing literature has failed to differentiate between different stages of farmland circulation and has particularly overlooked risks during the implementation stage. This paper will meticulously analyze the impact of various risks faced by farmers during the farmland transfer process on their transfer behavior. Thirdly, very few studies have incorporated multi-dimensional risk perception and risk preferences into a unified framework analysis. This paper will expand the decision-making model of farmer households under risk perception circumstances and further explore the moderating role of farmers' risk preferences in the influence process. This investigation will shed light on the diverse impact this farmers with varying risk preferences have on the overall outcome.

The remainder of this paper is structured as follows. Section 2 summarizes the review of the literature. Section 3 explains the data and methodology involved. Section 4 illustrates and discusses the empirical results Section 5 draws conclusions and proposes several policy recommendations.

2. Literature review and theoretical framework

2.1. Risk perception of a farmer

The essence of farmland circulation is a transaction of management rights, and since the management right is attached to the contract right with a time limit, the circulation of farmland has the characteristics of "term". In the process of property rights transactions within the time limit, the transaction entity may have opportunistic behavior, which causes risk problems. As members of the collective, farmers have the advantages of "property identity monopoly" and "property rights geographical monopoly" [14] and have absolute control over whether the farmland is transferred out. In this paper, we try to analyze the risk problem caused by the opportunistic behavior of both parties in the execution of the operating rights transaction from the perspective of the supply side of farmland. According to the Complex Ecosystem Theory (CES), risks are divided into economic, social, and ecological risks [35]. Therefore, the risks in the execution process of transfer-out are divided into three dimensions: land revenue risk, land use risk, and

non-farm employment risk.

Economic risk refers to the possibility that unreasonable transfer behavior will bring economic losses to all participants in agricultural land transfer. The transfer of agricultural land has certain economic risks for both parties to the transaction [36,37], in which the economic risks faced by the transferees (farmers) mainly focus on the integrity of land rent and the controllability of management rights. Specifically, it is land revenue risk. To pursue agricultural scale returns, the transferee of farmland is vulnerable to natural, market, and agricultural management risks in the operation process due to a lack of agricultural planting experience and reliable agricultural management personnel. Therefore, the transferee will likely change the business plans for the next year at will and even engage in opportunistic behaviors such as defaulting on rent, running away from the land, and not returning the farmland promptly [38].

Ecological risk refers to the possibility that after the transfer of farmland, the unreasonable land use behavior of the transferred households will affect the structure and function of the ecosystem of agricultural land—that is, land use risk. In order to meet the operating conditions, the transfer-in party of farmland may change the structure or function of the farmland ecosystem, resulting in a decrease in soil fertility due to trench transformation, cement hardening, or excessive fertilizers, resulting in land use risks. That is the risk of increased restoration costs for farmers due to land use change by the land transfer-in party.

Social risk is the possibility that unreasonable transfer behavior will cause social problems, produce social contradictions, and endanger social stability in agricultural land transfer [39]. Combined with existing studies, it is summarized as the risk of re-employment after circulation and the risk of stability of non-agricultural employment after transfer. In other words, it is a non-farm employment risk. Farmland has both functions of means of subsistence and social security. Under the continuous transfer of rural labor and an imperfect rural social security system, farmland has always been used as a retreat for migrant workers outside the farm. The lack of local employment opportunities and the "skill threshold" of non-farm employment in different places may lead to unemployment, resulting in the risk of non-farm employment that farmers will not be able to find employment in a timely and stable manner and receive total wages [16,40–43].

Risk perception originated in psychology and was later introduced into the study of consumer behavior problems. The theory suggests that the uncertain outcome of a decision may lead to a certain level of loss and that an individual's expectation of such loss is risk perception. The key to risk perception is uncertainty, which relies on individual subjective attitudes and intuitive judgments and impacts individuals' daily behavioral choices. Social psychology suggests that their perceptions impact individual behavior to form perceived usefulness and perceived ease of use, both of which can have an impact on behavioral attitudes. Individual behavioral intentions depend on attitudes and subjective norms, and behavioral intentions ultimately lead to actual actions [44]. Based on the expected value theory, economics believes that individual decision-makers calculate the expected return according to different behavioral outcomes and probability distributions and then select the optimal solution based on maximizing the expected return [45]. In uncertain situations, an individual's behavioral decisions are influenced by the likely expected benefits and the probability of occurrence [46]. According to social psychology theory and expectation theory, the risks caused by opportunistic behavior will cause farmers to form uncertain expected returns from farmland transfer [47], affecting farmers' decision-making behavior of farmland transfer [48].

Therefore, drawing on the decision-making model of farmland transfer without government intervention was established by Deininger et al. [49]. This paper expands it to explore the influence of risk perception on farmers' farmland transfer behavior.

2.2. Impact of risk perception on farmland transfer-out behavior

2.2.1. Expected benefits under farmers' decision not to transfer out their farmland

Farmers' income comes from their agricultural production income (Y) and non-farm labor income (W), and this paper assumes that the working hours of farmers are divided into agricultural working hours (L_a) and non-agricultural working hours (L_ω), and $L_a + L_\omega = \overline{L}$. Therefore,

Farmers' agricultural production income is

$$Y = \alpha^{1-\eta}\left(\overline{T}^{A} L_a{}^{B} \overline{K}^{c}\right)^{\eta} \tag{1}$$

in Equation (1), $\overline{T}$ is the initial land owned by the farmer, L_a is the agricultural labor time invested by the farmer, $\overline{K}$ represents capital invested, α is agricultural productivity, and P is the price of food. a, b, and c denote the relative importance of the three factors of land, labor, and capital, respectively. A+b + c = 1, η<1 indicates that the agricultural production function is one of diminishing returns to scale, and the agricultural productivity of labor is assumed to be the same.

Equation (2) is farmers' earnings from working outside the home are

$$W = (1-\Theta)\omega L_\omega, \Theta\epsilon[0,1] \tag{2}$$

where Θ is the probability of non-farm employment risk for farm households, ω is the wage rate, and L_ω is the time spent in off-farm labor in Equation (2). Then,

Equation (3) is expected benefits of the decision of farmers not to transfer out their farmland are

$$\pi_1 = P\alpha^{1-\eta}\left(\overline{T}^{A} L_a{}^{B} \overline{K}^{c}\right)^{\eta} + (1-\Theta)\omega L_\omega \tag{3}$$

2.2.2. Expected benefits under farmers' farmland transfer-out decisions

When farmers transfer out all their land, the income comes only from non-farm work and property income. The property income is the actual rent received by the farmer's farmland transfer out. In Equation (4), rent per unit area of farmland transfer out is γ, and the probability of land revenue risk (φ_1) will reduce the likelihood that farmers will recover the rent in full and reduce the expected return. The probability of occurrence of land use risk (φ_2) will increase the cost of farmland depletion and restoration, reduce the actual rent that farmers can receive, and $\varphi_1 \epsilon [0,1]$, the $\varphi_2 \epsilon [0,1]$. Therefore, the property income of agricultural land is R_1 as below:

$$R_1 = (1-\varphi_1)(1-\varphi_2)\gamma\overline{T} \tag{4}$$

The farming household's entire labor time is engaged in non-farm work, so their income from migrant workers is R_2 in Equation (5).

$$R_2 = (1-\varphi)\omega\overline{L} \tag{5}$$

Then the expected return of the farmer under the decision to transfer out the farmland is π_2 in Equation (6).

$$\pi_2 = (1-\varphi_1)(1-\varphi_2)\gamma\overline{T} + (1-\Theta)\omega\overline{L} \tag{6}$$

2.2.3. The equilibrium analysis

Whether or not the farmland is transferred out is the target result of farmers' pursuit of maximizing expected returns. Assuming Prob is the probability of farmers' farmland transfer-out, the objective function is Equation (7).

$$\max \pi = Prob[(1-\varphi_1)(1-\varphi_2)\gamma\overline{T} + (1-\Theta)\omega\overline{L}] + (1-Prob)\left[P\alpha^{1-\eta}\left(\overline{T}^{A}L_a{}^{B}\overline{K}^{c}\right)^{\eta} + (1-\Theta)\omega L_{\omega}\right] \tag{7}$$

To achieve the optimal solution under the constraint, Equation (8) is obtained.

$$\frac{\partial\pi}{\partial Prob} = (1-\varphi_1)(1-\varphi_2)\gamma\overline{T} + (1-\Theta)\omega\overline{L} - \left[P\alpha^{1-\eta}\left(\overline{T}^{A}L_a{}^{B}\overline{K}^{c}\right)^{\eta} + (1-\Theta)\omega L_{\omega}\right] \tag{8}$$

According to the Lagrangian formula, Equation (8) is zero, i.e.

$$(1-\varphi_1)(1-\varphi_2)\gamma\overline{T} + (1-\Theta)\omega\overline{L} = P\alpha^{1-\eta}\left(\overline{T}^{A}L_a{}^{B}\overline{K}^{c}\right)^{\eta} + (1-\Theta)\omega L_{\omega} \tag{9}$$

Under the assumption of farmers as rational persons, combined with Equation (9), the paper further analyzes as follows.

① When φ_1 increases, Equation (9) $_{\text{Left}}$ < Equation (9) $_{\text{Right}}$, so Equation (8)< 0, and *Prob* increases and π decreases, the farmer will not choose to transfer out farmland at this time; when φ_1 decreases, Equation (9) $_{\text{Left}}$ > Equation (9) $_{\text{Right}}$, so Equation (8) $_{\text{Right}}$ > 0, the *Prob* increases, the π increases, and the farmer will choose to transfer out the farmland at this time. When the perceived risk of land revenue increases, the expected return decreases, and the probability of farmers choosing farmland to transfer out decreases; conversely, the probability of farmland transfer out increases. Therefore, hypothesis 1 is proposed.

H1. The lower the perception of land revenue risk, the higher the probability that farmers will transfer out their farmland is.

② When φ_2 increases, Equation (9) $_{\text{Left}}$ < Equation (9) $_{\text{Right}}$, so that Equation (8)< 0, the *Prob* increases and π decreases when farmers do not choose to transfer out farmland; when φ_2 decreases, Equation (9) $_{\text{Left}}$ > Equation (9) $_{\text{Right}}$, so Equation (8)> 0, at this time, the *Prob* increases, the π increases, and the farmer will choose to transfer out the farmland. The probability of farmers' transferring out farmland decreases with the perception of the increasing land use risk and decreasing expected return decreases, and the probability of farmers choosing farmland to transfer out decreases; conversely, the probability of farmers' transfer-out of farmland increases. Therefore, hypothesis 2 is proposed.

H2. The lower the perception of land use risk, the higher the probability of transferring farmland out of farm households

In addition, according to the non-farm labor hours (L_{ω}), Equation (9) can be further transformed into equation (10).

$$(1-\varphi_1)(1-\varphi_2)\gamma\overline{T} + (1-\Theta)\omega L_a = P\alpha^{1-\eta}\left(\overline{T}^{A}\overline{L}^{B}\overline{K}^{c}\right)^{\eta} \tag{10}$$

③ When Θ increases, Equation (10) $_{\text{Left}}$ < Equation (10) $_{\text{Right}}$, so that Equation (8) < 0. At this point, the *Prob* increases and π decreases, and the farmer will not choose to transfer the farmland out; when Θ decreases, Equation (10) $_{\text{Left}}$ > Equation (10) $_{\text{Right}}$, so, Equation (8) > 0, the *Prob* increases, the π increases, the farmer will choose to transfer out of farmland at this time. When the perceived risk of non-farm employment increases, the expected return decreases, and the probability of farmers choosing farmland to transfer out decreases; conversely, the probability of farmers' transfer-out of farmland increases. Therefore, hypothesis 3 is proposed.

H3. The lower the perceived risk of non-farm employment, the higher the probability that farm households will transfer out

farmland.

2.3. The impact of risk perception and risk preference on farmland transfer-out behavior

Compared with risk perception, risk preference can be regarded as farmers' appetite and acceptance of risk events. Existing research indicates that individuals with high-risk preferences do not necessarily choose risk-averse approaches. Risk-averse individuals tend to be cautious in their behavioral decision-making, consider the results from the perspective of "avoiding disasters", and thus make relatively conservative behavioral choices [50]. According to Hillson et al. [51], the degree of risk preference reflects the psychological attitude of the actor toward risk and is a kind of information state opinion or tendency selected based on specific facts or events.

To explore the influence mechanism of risk perception and risk preference on farmers' farmland transfer-out decisions, this paper uses the VNM expected utility function $u(\omega)$ to analyze. Assuming that the initial wealth level of the farm households is ω, and the random variable z represents the expected return of farmland transfer-out with a variance of σ^2. *CE* as the is deterministic equivalence, meaning that the maximum expected return from a farmer's farmland transfer-out in a risky environment is the same as the return of a non-random deterministic equivalent *CE* return that does not differ. In other words, the *CE* can represent the expected return from the farmer's transfer out of the farmland. The deterministic equivalent implies that the following Equation holds [52].

$$u(\omega + CE) = \mathrm{E}[u(\omega + \widetilde{Z})] \tag{11}$$

in Equation (11), E (·) denotes the expectation, and the second-order Taylor series is expanded with ω centered on both sides of Equation.

$$u(\omega + CE) = u(\omega) + \mathrm{CE} \cdot u'(\omega) + o\left(CE^2\right) \tag{12}$$

$$E[u(\omega + \widetilde{Z})] = E\left[u(\omega) + \widetilde{Z}u'(\omega) + \frac{1}{2}\widetilde{Z}^2 u''(\omega) + o\left(\widetilde{Z}^3\right)\right] = u(\omega) + u'(\omega)\mathrm{E}(\widetilde{Z}) + \frac{1}{2}u''(\omega)E\left(\widetilde{Z}^2\right) + o\left[E\left(\widetilde{Z}^3\right)\right] \tag{13}$$

Combining equations (11)–(13) and using the variance $\sigma^2 = E(\widetilde{Z}^2) - E(\widetilde{Z})]^2$ formula, substitution simplification gives.

$$CE = \frac{1}{2}E\left(\widetilde{Z}^2\right)\left[\frac{u''(\omega)}{u'(\omega)}\right] + E(\widetilde{Z}) = -\frac{1}{2}\left\{\sigma^2 + [E(\widetilde{Z})]^2\right\}\left[-\frac{u''(\omega)}{u'(\omega)}\right] + E(\widetilde{Z}) \tag{14}$$

Combining equations (12)–(14), the absolute risk aversion coefficient in the Arrow-Pratt expected utility function framework is $R(\omega) = -u''(\omega)/u'(\omega)$, and the higher the value of $R(\omega)$, the lower the risk preference of farmers. CE represents the expected return of farmland transfer-out. σ^2 represents the variance of the expected return and also indicates the perceived risk of farmland transfer-out. From equation (14), it can be seen that the expected return from the transfer-out of farmland decreases with the increase of σ^2 and $R(\omega)$ increase. The greater the risk perception, the lower the expected return from farmland transfer-out; the more risk aversion, the lower the expected return from farmland transfer-out. In addition, the product of σ^2 and $R(\omega)$ has an impact on the expected return from the transfer out of farmland. The larger the product, the lower the expected return is. The numerical results show that risk perception and risk preference have an interactive effect on farmers' expected to return from farmland transfer-out, i.e., with the increase of risk perception, the risk attitude of aversion will accelerate the reduction of the expected return of farmland transfer, which will lead to a decrease in the probability of farmers choosing to transfer out farmland. Based on the above analysis, Hypothesis 4 and Hypothesis 5 are proposed.

H4. The higher the degree of risk preference of farm households, the higher the probability of transferring farmland out is.

H5. The interaction term between risk perception and risk preference has an impact on farmers' farmland transfer-out, and specifically, risk preference can decrease the inhibition effect of risk perception.

The impact of risk perception and preference on farmland transfer-out is presented in Fig. 1.

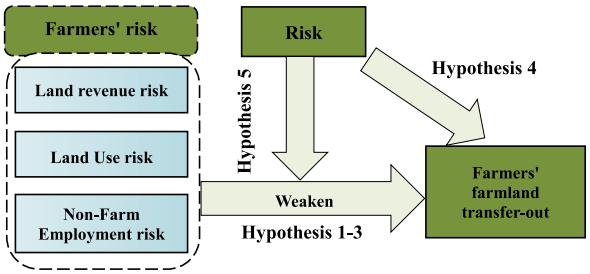

Fig. 1. Theoretical framework.

3. Data and methodology

3.1. Data sources

The data used in the statistical analyses were collected during a farm household survey conducted in August 2019 by a research group from Huazhong Agricultural University. The survey focused on the farmland transfer-out and cultivation of new agricultural business entities. Cao County, Shandong Province, and Jianli County, Hubei Province, China, are the sampling areas because both are strongly representative of the national rural development area. They belong to the plain area, and their economic development levels are in the middle of the country. In addition, their farmland transfer markets have developed in a relatively active state, and the new agricultural management subjects have developed earlier.

To collect information on the farmland transfer market more scientifically, all investigators received training on questionnaire survey methods and repeatedly revised the questionnaire through pre-survey. The survey sites were selected following the quota sampling method, with each survey site's county-level agricultural economic department recommending four representative townships (towns) following the requirements. Each township selected four to six administrative villages, with each administrative village randomly sampling about 30 farm households, for which the surveyors conducted one-on-one interviews and completed farm and village questionnaires. The survey involved eight townships (towns) and 48 administrative villages in Table 1; 1410 questionnaires were issued. The response rate has reached 98.5%. Excluding incomplete and non-compliant samples, 1389 valid samples comprised 699 from Cao County and 690 from Jianli County.

They excluded incomplete and non-compliant samples. A total of 1389 valid samples were returned, including 690 valid samples from Hubei Province and 699 valid samples from Shandong Province. The questionnaire efficiency reached 98.5%.

Regarding household head characteristics, 73.72% of the sample farmers were male, 26.28% were female, and the average age was 56.7. About 19.51% of those did not go to school, and 31.1%, 33.62%, 14.33%, and 1.44% have an elementary school, junior high school, high school/junior high school/technical school, and college and above educational level, respectively. In terms of household characteristics, the average number of household laborers was three persons per household, and the average total household income in 2019 was RMB 124,700, 82.2% of which was from non-farm income. The proportion of pure farming households, part-time households I (agricultural income is mainly supplemented by non-farm income), part-time households II (non-farm income is mainly supplemented by agricultural income), and off-farm households (all income comes from non-farm works) are 7.13%, 9.07%, 57.09%, and 26.71%, respectively. Regarding farmland characteristics, the average household contracted area of farmland is 7.98 acres, and the average number of plots is 3.6.28.37% of farm households transfer to the land, and 61.75% transfer out of farmland. The average value of farmland transfer-out rent was RMB 777.92 per acres. The overall risk perception of farmers was strong, with only 7.56% believing there was no risk in the transfer-out.

3.2. Variable description

Farmers' farmland transfer-out behavior is mainly the final decision made by farmers after assessing the risk of land transfer-out in the face of uncertainty, which is mainly impacted by personal characteristics, household characteristics, land characteristics, and risk perception.

Dependent variable: The behavior of farmland transfer-out mainly includes the decision to transfer out of farmland and the degree of farmland transfer-out. The dichotomous variable was used to indicate whether the household transferred farmland out, and the results were assigned with "Yes = 1, No = 0". If the answer is yes, another question, "How many acres of farmland has your family transferred out?" is asked. The transfer-out rate, the ratio of the actual area transfer to the household's contracted area, was used to measure the degree of farmland transfer-out.

Key independent variables: The key independent variables in this paper are risk perception and risk preference. According to Risk Theory, risk perception is the individual's beliefs and concerns about various uncertainties (Slovic, 1987). Risk perception was measured using a Likert scale by asking farmers whether they worried about various risks, and the responses were categorized as "not worried at all = 1; not very worried = 2; average = 3; quite worried = 4; very worried = 5". The principal component analysis showed that the KMO value was 0.85, and Bartlett's spherical test was significant at the 1% significance level, indicating that the sample was suitable for factor analysis. Reliability and validity tests were conducted on the measurement questions to ensure the effectiveness of the risk perception measure. The result of the reliability test, Cronbach's α, was 0.68, indicating that the overall reliability was good. The factor loadings of all measurement items after maximum variance orthogonal rotation were more significant than 0.5, indicating good convergent validity. Therefore, three common factors with eigenroots greater than one were extracted by principal component

Table 1
Sample size and regional distribution.

Parameters	Cao County, Shandong province				Jianli County, Hubei province				Total
	Zhuhongmiao Town	Shaozhuang Town	Liangditou Town	Guying Town	Wangshi Town	Fotanji Town	Checkerboard Town	Hongcheng Town	
Number of farming households	122	168	187	222	174	162	155	199	1389

analysis, with a cumulative variance contribution of 70% (Table 2).

Key independent variable: To obtain farmers' risk preference, this paper follows Ma et al. and Pan et al. [53,54]. Farmers were surveyed to rate five statements on a scale of 1–5, with higher values indicating higher agreement, i.e., greater preference for risk. Specifically, the five statements were "I would be the first to plant a new variety in my village because it is too risky","If I find a project that is profitable, I might borrow money to invest even if there is a possibility of losing money","We do not belong to a developed area here, so it is impossible to be rich without taking risks","If I have spare money, I may buy lottery tickets, and I may make much money if I am lucky", "In everyone's mind, I am a more adventurous person." The higher the score of Viewpoint 1, the more risk-averse farmers are, and this inverse indicator is transformed into a positive indicator, which is consistent with the evaluation direction of the other four views. The average number of the five questions was the risk appetite coefficient of farmers. The higher the rating of view, the stronger the risk preference of the farmer is.

Considering the possible endogeneity problem of mutual causality between risk preferences and farmland transfer-out decisions, the mean value of risk preferences of the remaining farmers within the farmer's village was used as a proxy variable and standardized. Because farmers within the same village have the same living environment and follow standard institutional rules. The adequate information exchange and communication between each other contribute to more convergent risk preference attitudes among farmers. However, farmers' decision to transfer out does not affect the risk preferences of other farmers in the village. Therefore, the proxy variables represent farmers' risk preferences well and effectively avoid the endogeneity problem caused by mutual causality.

The control variables include characteristics of household head variables, household characteristics, farmland characteristics, and village-level variables. The effect of age on farmland transfer-out decisions is uncertain. However, young and middle-aged farmers have a comparative advantage in working and a higher willingness to transfer out of farmland within a specific range. In contrast, older people have fewer non-farm employment opportunities and a lower probability of transfer out of farmland [55]. Male farmers with high physical health, previous work experience, and relatively more non-farm employment opportunities have a higher probability of farmland transfer-out [56]. Farmers who had received government-organized training in agricultural technology had higher returns from farming and a lower probability of farmland transfer out. Farmers with higher education levels have more opportunities to work outside the home and have a higher probability of transferring out of their farmland. Such households may have a stronger sense of property rights and tend to protect the stability of property rights to obtain long-term benefits rather than transfer them out [57]. The hierarchical differentiation of household heads has different preferences for farmland ownership, which affects the decision to transfer out [56]. Farmers with village cadre status are more likely to transfer farmland in and less likely to transfer out because they live in rural areas and have extensive social resources [58].

The higher-income households usually participate in non-farm employment and non-agricultural labor transfer, so they tend to transfer farmland out [59,60]. The household dependency ratio reflects the degree of household life stress and impacts farmers' household land decisions. The number of household participants in the new family agricultural insurance represents the level of institutional old-age security, which usually promotes farmland transfer-out by replacing the role of farmland security. When non-farm employment is more stable, the lower the role of the farmland security function, the higher the willingness of farming households to transfer out of farmland [61,62]. Household investment in fixed assets represents the impact of asset specialization on farming operations. The higher the investment in agricultural assets, the higher the sunk cost of farm households to abandon farming operations, which inhibits farmland transfer-out behavior [4]. The specific indicators and assignments are shown in Table 3.

Both the contracted area of the family and the degree of fragmentation will increase the cost of agricultural production and operation and then promote the willingness to transfer farmland out [63]. Farmers with better land field roads, irrigation conditions, and higher fertility of cultivated land tend to keep their farmland because they have a higher expectation of value addition due to good land conditions. The impact of the Chinese government's new round of land titling on farmland is not yet conclusive. On the one hand, clear property rights can reduce transaction costs and thus increase the probability of farmland transfer-out. On the other hand, the confirmation of rights can increase the endowment effect and thus discourage farmland transfer-out [64].

Village-level variables: The farm households will find off-farm jobs nearby, and the lower probability of transferring farmland out when the village is to the nearest township [55]. Higher land transfer-out rent rates imply higher returns to farmland transfer-out, prompting farm households to transfer out farmland. The higher the rent rate of land transfer-out, the higher the income from

Table 2
Risk perception measurement.

Dimensionality	Measurement question items	Factor load	Cronbach's α
Land revenue risk	The inability of the transfer-in party to pay rent promptly	0.689	0.892
	Transfer party reduces rent due to poor harvest	0.742	
	Before the transfer-out expires, the transfer-out stops farming or runs away	0.797	
	The deadline for the flow is up, but it is not returned in time	0.858	
	The transfer-out has not expired, and it is not easy to recover the land	0.818	
Land use risk	Farmland transfer-out parties to grow non-food crops	0.663	0.843
	Farmland transfer-out parties do farming on the land	0.837	
	Farmland transfer-out parties digging ditches on the land, etc.	0.839	
	Concrete hardening of farmland by the transfer-out of farmland	0.716	
	The transfer-out of farmland to the party using too much fertilizer, destroying the land force	0.574	
Non-farm employment risks	No other employment opportunities after the land are transferred out, thus losing their jobs	0.903	0.852
	Non-farm employment may be unstable after farmland is transferred out	0.883	

Table 3
Definition of variables and descriptive statistics.

Variable Category	Variable Name	Identify the problem and assign a value	Mean	S.D.
Dependent variable	Whether the farmland is transferred out	Does your household have farmland transfer out? No = 0; Yes = 1	0.616	0.486
	Transfer-out rate of farmland	Area of farmland transfer out/area under a family contract	0.210	0.347
Key independent variables	Land revenue risk	Factor analysis obtained	0.372	0.287
	Land use risk		0.307	0.257
	Non-farm employment risks		0.328	0.308
	Risk preference factor	1 = risk aversion; 5 = risk preference, increasing from 1 to 5 risk preference	2.365	0.001
Household head characteristics variables	Gender of a head of household	Female = 0; Male = 1;	0.737	0.440
	Age of head of household	Actual observations (years)	56.68	11.27
	Education level of the household head	Not in school = 1; Primary school = 2; Middle school = 3; High school/junior college/technical school = 4; College and above = 5	2.470	1.006
	Self-assessment of the health of the head of household	Very good = 1; 2 = good; 3 = fair; 4 = poor; 5 = very poor	2.254	1.048
	Type of household head account	Agricultural household = 1; Non-agricultural household = 0	1.029	0.169
	Occupation type of head of household	Full-time farming = 1; Part-time business farming = 2; Full-time non-farming = 3; Withdrawn from labor = 4; Not in labor = 5	2.030	1.118
	Whether the head of household participates in employment training	Yes = 1; No = 0	1.883	0.321
	Have you ever worked outside the home	Yes = 1; No = 0	0.475	0.499
	Whether it is a village cadre	Yes = 1; No = 0	0.033	0.179
	Household income	Total household income (take logarithm)	11.18	1.206
	Share of non-farm income	Non-farm income/net household income (%)	82.19	27.90
	Family support ratio	Number of people younger than 14 and older than 60 years/total number of people	0.252	0.271
	Percentage of insured persons	Number of participants in the new agricultural insurance/number of participants available in the household	0.931	0.176
	Family social capital	How many family members are in the career unit or filling the civil service? (Number of people)	0.167	0.487
	Family farming fixed assets	Present value of agricultural fixed assets (taking logarithms)	2.145	3.411
Farmland characteristics variables	Family contracted area	The contracted land area of farm households (mu)	7.989	5.569
	Number of land parcels	Number of plots of land contracted by families (blocks)	3.626	2.375
	Field roads	Very poor = 1 poor = 2; fair = 3; better = 4; very good = 5	3.414	1.210
	Irrigation conditions	Very poor = 1 poor = 2; fair = 3; better = 4; very good = 5	3.6	1.167
	Land fertility	Very poor = 1 poor = 2; fair = 3; better = 4; very good = 5	3.690	0.971
	Whether to confirm the right	Did you receive the land title certificate? Yes = 1; No = 0;	0.875	0.330
Village features	Distance of the village from the township	How many kilometers is your village from the nearest township (town)?	4.391	2.990
	Land transfer-out rental rate	What is the typical price of land transfer out in your village? (RMB)	866.1	271.8

transfer farmland, and the higher the probability of farmland transfer-out [14].

3.3. The econometric models

A model was developed to examine the impact of risk perception and risk preference on farmers' farmland transfer-out behavior.

$$Y_i = \alpha_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \sum_{m=1} \beta_5 C_{mi} + \varepsilon_i \quad (15)$$

Equation (15) identifies the two benchmark models. In model 1, Y_i denotes the i th farmer's decision to transfer out of farmland, which is a dichotomous variable ("1″ for transfer-out, "0″ for not transfer-out). X_{1i} denotes land revenue risk, X_{2i} denotes land use risk, X_{3i} denotes non-farm employment risk, and X_{4i} indicates the risk preference of the household head. C_{mi} indicates individual characteristics, household characteristics, farmland characteristics, and village characteristics. α_0 denotes the constant term and $\beta_1 - \beta_5$ denote the coefficients to be estimated, and ε_i denotes the error term assumed to conform to a normal distribution. In model 2, Y_i denotes the rate of farmland transfer-out, and the meanings of the remaining variables are the same with model 1.

When the dependent variable is whether the farmland is transferred out or not, it is a dichotomous variable and applies to the Probit model. When the dependent variable is the rate of farmland transfer-out, it is a continuous variable. Considering that the farmland transfer-out rate depends on the farmland transfer-out behavior and has a large number of zero values when the farmland is not transferred out, the Tobit model is applicable. To obtain more robust estimation results, OLS was also used for estimation.

To further identify the moderating impact of risk preferences and the heterogeneity in risk preferences for the impact of risk perception on farmers' farmland transfer-out behavior, the interaction terms of risk perception and risk preference were introduced into the model, respectively, as

$$Y_i = \alpha_0 + \beta_{11} X_{1i} X_{4i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \sum_{m=1} \beta_5 C_{mi} + \varepsilon_i \quad (16)$$

$$Y_i = \alpha_0 + \beta_{22} X_{2i} X_{4i} + \beta_1 X_{1i} + \beta_3 X_{3i} + \sum_{m=1} \beta_5 C_{mi} + \varepsilon_i \quad (17)$$

$$Y_i = \alpha_0 + \beta_{33} X_{3i} X_{4i} + \beta_1 X_{1i} + \beta_2 X_{2i} + \sum_{m=1} \beta_5 C_{mi} + \varepsilon_i \quad (18)$$

in Equation (16), $X_{1i}X_{4i}$ denotes the terms of land revenue risk-risk preference interaction. In Equation (17), $X_{2i}X_{4i}$ denotes the interaction term between land use risk and risk preference, and in Equation (18), $X_{3i}X_{4i}$ denotes the interaction term between non-farm employment risk and risk preference. The rest of the variables are consistent with Equation (15), and the dependent variable classification and model use are also consistent with Equation (15).

4. Results and discussion

4.1. Results

Table 4 shows the impact of risk perception and preference on farmland transfer-out behavior without interaction terms. The estimation results from models (1) and (2) show that land return, land use risk, and non-farm employment risk inhibit farmland transfer-out decision and the transfer-out rate at the 1% or 5% significance level, which verifies hypothesis 1. As a theoretical analysis, the possible risk loss in land transfer-out significantly inhibits farmers' farmland from transfer-out. Our findings are in line with the risk aversion principle. In addition, the estimated coefficients of the three types of risks show that the impact coefficient of land return risk is the highest, followed by the impact of land use risk, and the lowest is the non-farm employment risk. This indicates that, in the

Table 4
Effect of risk perception on farmland transfer-out behavior.

Variables	Whether the farmland is transferred out	transfer-out rate of farmland	
	(1) Probit model	(2) Tobit model	(3) OLS model
Key independent variables			
Land revenue risk	−1.153***(0.185)	−0.256***(0.039)	−0.256***(0.040)
Land use risk	−1.000***(0.204)	−0.187***(0.043)	−0.187***(0.043)
Non-farm employment risks	−0.442***(0.156)	−0.072**(0.033)	−0.072**(0.034)
Risk preference	0.078*(0.046) (0.046)	0.019** (0.009)	0.019** (0.009)
Household head characteristics			
Gender	−0.343***(0.115)	−0.050**(0.023)	−0.050**(0.023)
Age	0.004 (0.005)	0.001 (0.001)	0.001 (0.001)
Education level	−0.024 (0.051)	0.019*(0.010)	0.019*(0.011)
Self-assessment of the health	0.075*(0.045)	0.012 (0.009)	0.012 (0.009)
Occupation type	0.506***(0.047)	0.153***(0.008)	0.153***(0.009)
Whether the head of household	−0.199 (0.134)	−0.052*(0.028)	−0.052*(0.028)
Ever worked outside the home	0.136 (0.089)	0.017 (0.018)	0.017 (0.019)
Whether he/she is a village cadre	−0.200 (0.135)	−0.040 (0.028)	−0.040 (0.028)
Family Characteristics			
Household income	0.115***(0.040)	0.029***(0.008)	0.029***(0.008)
Share of non-farm income	0.007***(0.002)	0.001***(0.000)	0.001***(0.000)
Family support ratio	−0.348*(0.199)	−0.081**(0.041)	−0.081*(0.041)
Percentage of insured persons	0.013 (0.154)	−0.037 (0.031)	−0.037 (0.031)
Family social capital	−0.059 (0.088)	−0.013 (0.018)	−0.013 (0.018)
Investment in household agricultural assets	−0.041***(0.013)	−0.008***(0.003)	−0.008***(0.003)
Farmland Characteristics			
Family contracted area	0.017*(0.010)	−0.001 (0.002)	−0.001 (0.002)
Number of land parcels	0.084***(0.021)	−0.000 (0.004)	−0.000 (0.004)
Field roads	0.050 (0.039)	0.015*(0.008)	0.015*(0.008)
Irrigation conditions	−0.083*(0.043)	−0.020**(0.009)	−0.020**(0.009)
Land fertility	0.055 (0.048)	0.017*(0.010)	0.017*(0.010)
Village Features			
Farmland titling	−0.127 (0.135)	−0.062**(0.027)	−0.062**(0.027)
Land transfer market price	0.001***(0.000)	0.000***(0.000)	0.000***(0.000)
Distance of the village from the township	0.021 (0.014)	0.009***(0.003)	0.009***(0.003)
Constant term	−2.349***(0.672)	−0.190 (0.140)	−0.190 (0.141)
Maximum likelihood log value	−606.18	−361.37	
LR chi2 value	580.97	714.73	
F-value			35.45
pseudo R^2	0.3240	0.4972	0.3975

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively, with robust standard errors in parentheses.

Table 5
Effects of risk perception and risk preference on farmland transfer-out behavior.

Variables	Whether the farmland is transferred out	transfer-out rate of farmland	Whether the farmland is transferred out	transfer-out rate of farmland	Whether the farmland is transferred out	transfer-out rate of farmland
	(4) Probit	(5) Tobit	(6) Probit	(7) Tobit	(8) Probit	(9) Tobit
Key independent variables						
Land revenue risk	−1.157***(0.185) ((0.185))	−0.259*** (0.039)	−1.151***(0.185)	−0.255*** (0.039)	−1.162***(0.185)	−0.259*** (0.039)
Land use risk	−0.985***(0.205)	−0.179*** (0.043)	−0.995***(0.204)	0.014 (0.014)	−1.001***(0.204)	−0.187*** (0.043)
Non-farm employment risks	−0.454***(0.157)	−0.076** (0.033)	−0.446***(0.156)	−0.073** (0.033)	−0.442*** (0.157)	−0.072** (0.033)
Risk preference	−0.018 (0.064)	−0.008 (0.013)	0.044 (0.071)	0.014 (0.014)	−0.016 (0.069)	0.001 (0.014)
Land revenue risk* Risk preference	0.283** (0.144)	0.083***(0.029)				
Land use risk* Risk preference			0.115 (0.179)	0.018 (0.036)		
Non-farm employment risk* Risk preference					0.268*(0.149)	0.046*(0.026)
Household head characteristics						
Gender	−0.332***(0.115)	−0.049** (0.023)	−0.343***(0.115)	−0.050** (0.023)	−0.335***(0.115)	−0.051** (0.023)
Age	0.004 (0.005)	0.001 (0.001)	0.004 (0.005)	0.001 (0.001)	0.004 (0.005)	0.001 (0.001)
Education level	−0.029 (0.051)	0.018*(0.010)	−0.026 (0.051)	0.019*(0.011)	−0.028 (0.051)	0.019*(0.010)
Self-assessment of the health	0.077*(0.045)	0.012 (0.009)	0.076*(0.045)	0.012 (0.009)	0.075*(0.045)	0.012 (0.009)
Occupation type	0.511***(0.047)	0.154***(0.008)	0.507***(0.047)	0.153***(0.008)	0.509***(0.047)	0.153***(0.008)
Whether the head of household	−0.200 (0.135)	−0.052*(0.028)	−0.202 (0.135)	−0.052*(0.028)	−0.203 (0.135)	−0.052*(0.028)
Ever worked outside the home	0.144 (0.089)	0.018 (0.018)	0.137 (0.089)	0.017 (0.018)	0.138 (0.089)	0.017 (0.018)
Whether he/she is a village cadre	−0.198 (0.136)	−0.038 (0.028)	−0.202 (0.135)	−0.039 (0.028)	−0.204 (0.136)	−0.041 (0.028)
Family Characteristics						
Household income	0.114***(0.040)	0.029***(0.008)	0.114***(0.040)	0.029***(0.008)	0.111***(0.040)	0.029***(0.008)
Share of non-farm income	0.007***(0.002)	0.001***(0.000)	0.007***(0.002)	0.001***(0.000)	0.007***(0.002)	0.001***(0.000)
Family support ratio	−0.346*(0.199)	−0.082** (0.041)	−0.345*(0.199)	−0.081** (0.041)	−0.328*(0.199)	−0.076*(0.041)
Number of participants as a percentage	0.034 (0.154)	−0.032 (0.031)	0.020 (0.154)	−0.036 (0.031)	0.024 (0.154)	−0.036 (0.031)
Family social capital	−0.045 (0.088)	−0.009 (0.018)	−0.056 (0.088)	−0.013 (0.018)	−0.055 (0.088)	−0.013 (0.018)
Investment in household agricultural assets	−0.041***(0.013)	−0.008*** (0.003)	−0.041***(0.013)	−0.008*** (0.003)	−0.040***(0.013)	−0.007*** (0.003)
Farmland Characteristics						
Family contracted area	0.017*(0.010)	−0.000 (0.002)	0.017*(0.010)	−0.001 (0.002)	0.017*(0.010)	−0.000 (0.002)
Number of land parcels	0.084***(0.021)	−0.000 (0.004)	0.084***(0.021)	−0.000 (0.004)	0.083***(0.021)	−0.000 (0.004)
Field roads	0.056 (0.040)	0.017**(0.008)	0.051 (0.039)	0.015*(0.008)	0.048 (0.040)	0.014*(0.008)
Irrigation conditions	−0.085**(0.043)	−0.021** (0.009)	−0.082*(0.043)	−0.020** (0.009)	−0.082*(0.043)	−0.020** (0.009)
Land fertility	0.056 (0.048)	0.017*(0.010)	0.055 (0.048)	0.017*(0.010)	0.056 (0.048)	0.017*(0.010)
Village Features						
Whether to confirm the right	−0.110 (0.136)	−0.059** (0.027)	−0.121 (0.135)	−0.062** (0.027)	−0.113 (0.136)	−0.061** (0.027)
Land transfer market price	0.001***(0.000)	0.000***(0.000)	0.001***(0.000)	0.000***(0.000)	0.001***(0.000)	0.000***(0.000)
Distance of the village from the township	0.020 (0.014)	0.009***(0.003)	0.021 (0.014)	0.009***(0.003)	0.020 (0.014)	0.009***(0.003)
Constant term	−2.377*** (0.674)	−0.187 (0.139)	−2.336***(0.673)	−0.187 (0.140)	−2.322***(0.673)	−0.183 (0.140)
Maximum likelihood log value	−604.29	−357.31	−605.97	−361.25	−604.45	−359.77
LR chi2 value	584.75	722.86	581.38	714.98	584.43	717.94
Pseudo R^2	0.3261	0.5029	0.3242	0.4974	0.3259	0.4994

Note: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively, with robust standard errors in parentheses.

Table 6
Robustness analysis of the effects of risk perception and risk preference on farmland transfer-out behavior.

Variables	Whether the farmland is transferred out	transfer-out rate of farmland	Whether the farmland is transferred out	transfer-out rate of farmland	Whether the farmland is transferred out	transfer-out rate of farmland	Whether the farmland is transferred out	transfer-out rate of farmland
	(10) Probit	(11) Tobit	(12) Probit	(13) Tobit	(14) Probit	(15) Tobit	(16) Probit	(17) Tobit
Land revenue risk	−1.146***(0.184)	−0.254*** (0.039)	−2.796***(0.761)	−0.689*** (0.146)	−1.144***(0.184)	−0.253*** (0.039)	−1.153***(0.185)	0.259***(0.039)
Land use risk	−1.001***(0.204)	−0.187*** (0.043)	−0.985***(0.205)	−0.179*** (0.043)	−1.661***(0.819)	−0.299*(0.163)	−1.000***(0.204)	−0.185*** (0.043)
Non-farm employment risks	−0.448***(0.156)	−0.074**(0.033)	−0.454***(0.157)	−0.075**(0.033)	−0.453***(0.156)	−0.074**(0.033)	−1.655**(0.681)	−0.356 (0.138)
Risk preference	0.094*(0.059)	0.024**(0.012)	−0.083 (0.098)	−0.019 (0.019)	0.037 (0.091)	0.015 (0.018)	−0.016 (0.084)	0.000 (0.016)
Land revenue risk* Risk preference			0.451**(0.201)	0.118***(0.038)				
Land use risk* Risk preference					0.183 (0.220)	0.031 (0.044)		
Non-farm employment risk* Risk preference							0.332*(0.181)	0.077**(0.037)
Control variables	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Constant term	−2.124***(0.689)	−0.135 (0.143)	−2.428***(0.703)	−0.210 (0.145)	−2.210***(0.701)	−0.148 (0.145)	−2.368***(0.703)	−0.180 (0.145)
Maximum likelihood log value	−606.3962	−361.4382	−603.8429	−356.6801	−606.0491	−361.1850	−604.7138	−359.2110
LR chi2 value	580.94	714.61	585.65	724.13	581.24	715.12	583.93	719.07
Pseudo R^2	0.3237	0.4972	0.3266	0.5037	0.3241	0.4975	0.3256	0.5002

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively, with robust standard errors in parentheses.

absence of a perfect farmland security system, the uneven risk-sharing mechanism leads farmland transfer-out households to bear the economic losses arising from the poor operation of agricultural operators. That is an essential constraint for farmland transfer-out households to realize their claims of farmland property gains. The high risk of land use is mainly reflected in the integrity and sustainable use of farmland. Farmland transfer households need to spend more on repairing farmland after repossession, reducing the expectation of farmland revenue and thus discouraging farmland transfer-out. Furthermore, the non-farm employment risk will lower the expected return of farmland transfer-out, thus reducing the probability of farmland transfer-out.

The positive effects of risk preference on farmland transfer-out decision and farmland transfer-out rate were statistically significant at 5% or 10% significance levels, respectively, and hypothesis 4 was verified, indicating that higher risk preference implies a higher probability of farmland transfer-out when they are willing to take risks in the decision-making process to pursue higher returns.

Among the remaining control variables, the rate of farmland transfer-out is higher for female household heads, possibly because farming operations require greater physical strength. The age of the household head was insignificant because there are two possible directions for the influence of age. One is that older farmers may be more conservative and tend to maintain the original state, so they are unwilling to transfer out or into the land; the other is that older farmers will transfer out the land because large-scale farmers usually require more capital investment, efficient management, and farming technology, which are not easy for older farmers to obtain. The higher the education and health level of the household head, the higher the probability of farmland transfer out. Non-farm occupation promotes farmers' farmland transfer-out. People with high education levels and healthy physical strength find better non-farm employment opportunities more efficiently, which increases the willingness to transfer farmland out.

Farmers' participation in government-organized agricultural training negatively affects farmland transfer-out at the 10% significance level. Training can improve farmers' agricultural management ability and increase the expected return without transfer-out. The statistically insignificant effect of whether the householder is a village cadre on farmland transfer-out behavior is that, on the one hand, village cadres are more likely to operate agriculture themselves because they have lived in rural areas for a long time. On the other hand, when the policy promotes moderate-scale farming and even includes it in the administrative assessment, village cadres, as both "agents" and "family members," need to play a leading role in transferring farmland [24]. From the results of the household characteristics estimation, the rest of the variables are consistent with theoretical expectations, except for the number of participants and household social capital, which have an insignificant impact on farmland transfer behavior, thus indicating that the current formal institutional security is still not able to offset the function of farmland security. The proportion of people in the household who work in institutions is insignificant, probably because the household life pressure is relatively low, and farmers want to grow food for their consumption to pursue a higher level of food security.

The effect of farmland characteristics on transfer-out behavior is consistent with expectations. However, irrigation conditions have a negative impact on farmland transfer-out behavior, probably because the better the irrigation conditions, the more convenient the conditions for farmland operation and the lower the production cost. Although village farmland titling insignificantly affects the farmers' transfer-out decision, it negatively affects the transfer-out rate at the 5% significance level. The possible explanation is that clear property rights bring more substantial endowment effects to farmers and thus do not affect or even inhibit the transfer-out of farmland. The market rent rate of land transfer-out is significant and positive because the higher the market price of farmland transfer-out, the higher the expected return of farmland transfer-out. The distance of the village from the nearest township positively affects the transfer of farmland, indicating that the more farmers are engaged in non-farm employment opportunities, the higher the probability of transferring farmland out.

Table 5 shows the effect of risk perception on the farmland transfer-out behavior of farmers with different risk preferences. This section introduces the interaction term among three types of risks and farmers' risk preferences, respectively, and models (4) and (5) show that the interaction term between land return risk and risk preferences significantly promotes farmland transfer-out decision at 5% statistical level and farmland transfer-out rate at 1% statistical level. The results indicate that the coefficient of farmers' risk preferences plays a mitigating effect in the negative relationship between land return risk inhibiting moderating effect for farmland transfer-out. For farmers, the increase in land return risk reduces the expected return of farmland transfer-out, and the increase in risk preference increases the value of farmland transfer-out. However, the decrease in expected return due to land return risk is less than the increase in the value of farmland transfer out due to risk preference.

The estimation results of models (6) and (7) show that the interaction term of land use risk and risk preference on farmland transfer-out behavior is not significant at the statistical level, indicating that the coefficient of risk preference does not moderate the effect of land use risk on farmland transfer-out behavior. The effect of perceived land use risk on discouraging farmland transfer-out by reducing expected returns is not significant with the increase of risk preference, probably because the damage, such as land hardening, the perception of land use risk may no longer be a constraint on farmland transfer-out because it is easier to regulate and generates a less expected economic loss.

The results of models (8) and (9) show that the interaction term between non-farm employment risk and risk coefficient is positively significant at the 10% significance level. Risk preference also plays a mitigating moderating role in the negative effect of non-farm employment risk on farmland transfer behavior. The results suggest that the binding of non-farm employment risk on farmland transfer-out due to the reduction in expected returns caused is deconstructed as risk preference increases.

4.2. The robustness test

To further analyze the moderating role of risk preferences and to obtain robustness results, this paper chooses two ways to test them. The first way: are proxy variables. The indicator of the risk preference coefficient uses the farmer's own risk preference coefficient to replace the mean value of risk preference of the rest of the farmers within the farmer's village. The model constructed in this

paper is used to re-regress. Table 6 shows the results of the robust regressions, where all three types of risk perception and risk preference variables in models (10) and (11) are significant, and the direction of impact is consistent with models (1) and (2), respectively. Models (12) and (13) represent the interaction effects of land return risk and risk preference, and the interaction terms are positively significant at the 5% and 1% statistical levels, respectively, consistent with the estimation results of models (4) and (5). Models (14) and (15) represent the interaction effects of land use risk and risk preference, and the interaction terms are statistically insignificant, consistent with the estimated results of models (6) and (7). Models (16) and (17) report the results of the interaction effects of non-farm employment risk and risk preference, showing that the interaction terms are both significantly positive, consistent with the estimation results of models (8) and (9). The empirical results of this paper are robust.

The second way of robustness testing: is sub-sample regression. The coefficients of risk preferences are averaged, with those less than the mean being "low" risk preferences and those more remarkable than the mean being "high" risk preferences. The risk preference coefficients are divided into subsamples of "low" and "high" risk preferences. We examine the effect of risk perception on farmland transfer-out behavior under different risk preferences. Models (18) to (21) show that the perception of land risk has a negative effect on the decision to transfer out farmland and the transfer-out rate regardless of whether the risk preference is "high" or "low." Comparing models (18) and (20), we find that the negative effects of land return risk and non-farm employment risk perception on farmland transfer-out behavior are significantly lower for "high" risk preference compared to "low" risk preference. This suggests that farmers' risk preferences can effectively reduce the inhibitory effects of land return and non-farm employment risks on farmland transfer-out. In models (19) and (21), except for the effect of land use risk, the negative effects of land rights risk and off-farm employment risk on the farmland transfer-out rate are significantly reduced, again indicating that risk preference plays a moderating role in the negative effects. It may be since farmers with high-risk preferences, who have more robust risk tolerance and psychological preparedness, will not choose a risk-averse conservative approach and continue to have the possibility of farmland transfer-out. The results in Table 7 remain broadly consistent with those in Table 5, further indicating the robustness of the results of the empirical tests in this paper.

5. Conclusions and policy implications

More problems have emerged with developing the land transfer market and new agricultural operators. For example, the parties of land transfer-in reduce the rent, do not pay the rent on time, or do not return the land on time or pollute the land, making the land transfer-out farmers' economic returns lack security. Risk perceptions may hinder the land transfer-out.

This paper empirically examines the impact of risk perception on farmland transfer-out behavior and the moderating effect of risk preferences using the survey data from 1389 farm households in Cao County, Shandong province, and Jianli County, Hubei province, in 2019. The results showed that (1) the perceptions of land return risk, land use risk, and non-farm employment risk significantly inhibited farm households' farmland transfer-out decisions and transfer-out rates. (2) Land return risk has the most significant negative effect on farmland transfer-out behavior, followed by land use risk and non-farm employment risk. (3) There is a moderating effect of risk preference in the impact of risk perception on farmers' farmland transfer-out behavior. Specifically, risk preference can attenuate the negative effect of risk perception.

Due to differences in risk preferences, the perceived effects of land returns and non-farm employment risks on farmland transfer-out differ significantly among farmers. Therefore, farmland risk management policies need to consider the differentiated characteristics of farmers' risk preferences when formulated so that the policy outcomes can be more targeted. In general, paying attention to the risk sources in farmland transfer-out and effectively controlling the risks to protect farmers' land property returns is the key to getting out of the dilemma of the farmland transfer market. The Chinese governments at all levels should establish a better system of follow-up supervision and dispute mediation to prevent possible conflicts of interest in the transfer out of farmland. Specifically, constructing systems such as the entry mechanism for large-scale management qualifications and the transfer-out guarantee fund should strictly

Table 7
The effect of risk perception on farmland transfer-out behavior under different risk preferences.

Variables	Low-risk preference		High-risk preference	
	Whether the farmland is transferred out	transfer-out rate of farmland	Whether the farmland is transferred out	transfer-out rate of farmland
	(18) Probit model	(19) Tobit model	(20) Probit model	(21) Tobit model
key independent variables				
Land revenue risk	−1.453***(0.270)	−0.323***(0.058)	−0.881***(0.268)	−0.204***(0.052)
Land use risk	−1.001***(0.303)	−0.167***(0.063)	−0.975***(0.288)	−0.173***(0.056)
Non-farm employment risks	−0.745***(0.238)	−0.125**(0.050)	−0.337 (0.225)	−0.033 (0.044)
Control variables	Controlled	Controlled	Controlled	Controlled
Constant term	−1.985**(0.925)	−0.135 (0.191)	−1.405 (1.133)	0.008 (0.210)
Maximum likelihood log value	−297.4363	−182.8658	−285.4516	−145.7297
LR chi2 value	316.20	389.00	290.61	377.07
pseudo R^2	0.3471	0.5154	0.3373	0.5640

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively, with robust standard errors in parentheses.

prevent phenomena such as an imbalance in revenue distribution. The government strengthens land use regulations and prohibits excessive large-scale land hoarding and changes in farmland use. It also provides employment information, risk guarantee, and contract review services to reduce farmers' risk perception.

Author contribution statement

Jingjing Wan: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Bo Wang: Performed the experiments; Analyzed and interpreted the data.

Yuanhong Hu: Contributed reagents, materials, analysis tools or data; Wrote the paper.

Cheng Jia: Analyzed and interpreted the data.

Data availability statement

The authors do not have permission to share data.

Additional information

No additional information is available for this paper.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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